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Dr. LEE, President, in the Chair.

Col. T. Schaffner, Kentucky, U.S.A.,
was balloted for and duly elected a Fellow of the Society.

Extract of a Letter from Professor Hansen to the Astronomer Royal, dated Gotha, 1861, Oct. 18.

My principal labours advance progressively, and I work at them with pleasure. Events in the last summer have indeed occasioned some delay, and my other various avocations also often create cessations, but nevertheless I proceed. The working out of the new terms depending upon the planets, which I mentioned in my last letter, has occasioned a considerable addition to the labour of the calculation of the secular variation of the Moon's mean longitude, which I have not yet quite completed. I must in fact execute in regard to these terms as great a labour as in the calculation of the lunar perturbations themselves. I must carry on the approximations until the values at last substituted come out again. These terms are far greater than I suspected at first, and the circumstance that here the coefficients of the terms which have very small divisors become remarkably large particularly increases this labour. In the lunar perturbations themselves the analogous terms have only small coefficients. I am, I may say, perfectly

convinced that the value of the secular variation which I have before calculated from theory and assumed in the Lunar Tables must again come out, although I have considerably changed the method of calculation.

In the calculation of the secular variation of the mean longitude, I have set out with the proposition that the element which I have always denoted by Ξ has no influence over it. This proposition I have already proved, even to the cube of the disturbing forces, in my third memoir upon the perturbation of the small planets, and the proof holds also for the Moon. Further, the numerical equations of condition have shown me that this proposition is true even for the higher powers of the disturbing forces, at least to a considerable extent.

I have calculated anew the principal part of the perturbations of the longitude, of the radius vector, and of the latitude, and obtained such an agreement with the coefficients used by me in the Lunar Tables, and derived from the previous theoretical calculations that the differences in the individual coefficients amount only to a few hundredths of a second of arc. A new calculation of the secular variation of the motion of the perigee is also finished, and the deviation of the coefficient thus found from that of the Lunar Tables scarcely amounts to $0''{\cdot}4$. Now this coefficient, multiplied only by $2\,e$, enters into the longitude; and as $2\,e$ is nearly $=\frac{1}{9}$, this difference is of no greater significance than $0''{\cdot}04$ in the coefficient of the secular variation of the mean longitude.

As I have brought such accuracy into my theoretical determinations of the various parts of the Lunar Theory, it of course follows that I do not need to deem the cry which some have raised concerning empiricism finding place therein deserving of the least notice.

In order, however, as much as possible to comply with every reasonable desire concerning the early publication of my theoretical determination of the coefficients of the Lunar Theory, I have occupied myself, for some short time past, with putting together and sending to the press my calculation of the principal perturbations, which, as stated above, has been executed afresh. As soon as possible will follow, also, the publication of the calculation of the smaller coefficients. You will ask perhaps why I then do not publish the first calculations, which were finished long ago, before the completion of the Lunar Tables? and I answer, that I executed the last approximations in that calculation by substitution of the differences with the preceding approximation, and that therefore, by the publication of these calculations, a complication would arise which could only be made intelligible with great difficulty.

In the publication the result must proceed from *one* fountain; and it was necessary, therefore, that a new approximation should be calculated, with the full values of the coefficients. Only in this manner can I make myself clear, and place every

one in a position to be able to examine with ease the individual parts of my calculation.

With regard to the two small errors in the Lunar Tables which you communicate to me, they have arisen in this manner:—Page 86, Arg. 37 and (a) have, according to my present re-calculation, been calculated by my former computer, who has made so many errors, with an incorrect coefficient of $(c-18)^3$. The influence of this error, however, is so insignificant that it can, even in the year -800, produce an effect, at the most, of $1''\cdot8$ upon the Moon's longitude, and, as a matter of course, still less in subsequent centuries. I consider, therefore, its correction to be superfluous. Page 77, Arg. 10, Year -500, $56\cdot619$ was written by mistake instead of $56\cdot691$.

Note by the Astronomer Royal.

The small errors to which Professor Hansen alludes in the last paragraph were pointed out by Dr. Hincks to the Astronomer Royal, in a letter dated 1861, Sept. 16. Dr. Hincks remarks, "The whole columns 37 and (a), p. 86, are miscalculated, the error in the former being proportional to the cube of the number of centuries before 1800. $9\cdot1823^{37} + 275^{(a)}$ ought to be $9\cdot1350 + 330$; and so in other instances down to 1600, when the error disappears. I happened to notice a minor error in p. 77, -500, Arg. 10, where $56\cdot619$ is printed for $56\cdot691$. This, however, produces no sensible error."

On a Result deduced by M. D'Abbadie from Observations of the Total Solar Eclipse of 1860, *July* 18. By the Astronomer Royal.

In the *Compte Rendu* of the French Academy for the meeting of 1860, November 12 (tome li.), M. Antoine D'Abbadie has given an account of his observations of the eclipse of July 18, and in particular of his measures of the height of a certain red prominence A, to which my present remarks are confined. The telescope employed had an aperture of $72^{mm}\cdot5$ ($2\cdot9$ inches nearly), a focal length of 800^{mm} (32 inches nearly), and was used with a magnifying power 47. The micrometer consisted of a glass plate in the field of view, bearing a net of equal divisions, which divided the whole field into squares of $51''$ each side.

Omitting all observations except those which I have specified, M. D'Abbadie's record is as follows:—

No. de l'Observation.	Temps Moyen.	Phénomène Noté.	Angle reduit en hauteur.
	h m s		′
3	2 47 45	Hauteur de A, 1·3 division (probablement 2·3).	1·9
5	2 48 26	Hauteur de A, 1·3 division, dont une en diagonale.	1·4
7	2 49 27	Hauteur de A, 0·7 division.	0·6

upon which he founds the following inferences:—

"En calculant le mouvement relatif des deux astres par les Tables de MM. Hansen et Le Verrier, et en comparant les différences à celles qu'on deduit de mes observations relatées ci-dessus, on obtient les résultats suivans,—

Numeros.	Diminution observée dans la hauteur de la prot. A.	Mouvement correspondant calculé de cette partie du disque.	Mouvement maximum calculé dans la direction même du mouvement relatif des deux astres.
	″	″	″
De 3 à 5	30	15·0	18·3
De 5 à 7	52	22·4	27·2

"Ici, la decroissance observée est plus de deux fois celle qui serait produite par le simple mouvement relatif des deux astres."

We owe it entirely to the candour of M. D'Abbadie and to the completeness of his published statement, that we are in any way enabled to criticise his conclusions. I trust, therefore, that, in expressing my inability to agree with M. D'Abbadie as to the method of treating his observations and as to the results to be drawn from them, I may be understood as offering to him my thanks and those of other persons interested in this discussion, for the clear and full account of his original observations, from which we are all enabled to frame our own deductions.

The conclusion of M. D'Abbadie regarding the discordance between the observed decrease of the prominence and the computed change in relative positions of the Sun and Moon, rests *entirely* upon his arbitrary correction of the first observation; where his recorded measure was 1·3, which measure he has changed with the simple remark "probablement 2·3", and has used so changed in the subsequent computations. There is nothing to lead to the supposition that any circumstance attending the observation itself called for a change. It has been made, as far as we can judge, simply because the progress in the measured height of the protuberance between 3 and 5 is inconsistent with that between 5 and 7: it has, in fact, the wrong sign.

But if we are permitted to make such changes, where shall we stop? Why not alter the measure 5 instead of 3, which would have led to a discordance in the opposite direction? I conceive that it is much safer to use the observations as they

stand, to extract from them the best result which mathematics enable us to draw, to form the numerical values of the residual errors, and to judge whether these can properly be attributed to error of observation.

Adopting, then, for observation 3 the *original* value 1·3, and considering the diagonal measure in observation 5 as 1·4, we have the following measures of the height of the prominence:—

No.	Mean Time. h m s	Height of A in divisions.	Height of A in seconds.
3	2 47 45	1·3	66
5	2 48 26	1·7	87
7	2 49 27	0·7	36

Let x be the height of the prominence at $2^h\ 47^m\ 0^s$, y the decrease in its height for 1^m. Then we have

$$x - y \times 0{\cdot}75 = 66$$
$$x - y \times 1{\cdot}43 = 87$$
$$x - y \times 2{\cdot}45 = 36$$

Treating these by the method of Probable Errors, we obtain the equations

$$3x - y \times 4{\cdot}63 = 189{\cdot}0$$
$$x \times 4{\cdot}63 - y \times 8{\cdot}60 = 262{\cdot}1$$

by solution of which, $x = 93{\cdot}8$, $y = 20$.

The rate of change for 1^m, therefore, inferred from the observations, is 20″, agreeing sensibly with 22″ given by the computed relative motion of the Sun and Moon.

If we substitute for the formula $93{\cdot}8 - 20 \times t$ (where t is expressed by fractions of a minute) in each of the observations, we obtain

No.	Computed Height of Prominence.	Observed Height of Prominence.	Excess of Observed Height.
	″	″	″
3	78·8	66	−12·8
5	65·2	87	+21·8
7	44·8	36	− 8·8

From my own experience in observations of eclipses, I conceive that these "excesses," though very large, are not beyond possibility. The second measure (in which it seems to have been necessary to resort to a comparison with the diagonal of the square, I can scarcely imagine why) was evidently made under unfavourable circumstances; and the power of the telescope was low.

I think that M. D'Abbadie's inference is not sustained by his observations.

Royal Observatory, Greenwich,
1861, October 22.

Total Solar Eclipse, 1861, *Dec.* 31.
By J. R. Hind, Esq.

The following Table, exhibiting the path of the Moon's shadow over the African continent, in the eclipse of 1861, Dec. 31, has been derived from accurate calculations founded upon the Tables of Le Verrier and Hansen, assuming the diameters of Sun and Moon as there adopted:—

Greenwich Mean Time.	N. Limit.		Central Line.		S. Limit.		Duration of Totality on Central Line.
	Long.	Lat.	Long.	Lat.	Long.	Lat.	
h m	° ′	° ′	° ′	° ′	° ′	° ′	m s
2 33	18 13 W.	14 30 N.	18 8 W.	14 11 N.	18 2 W.	13 52 N.	1 43
2 38	16 24	15 36	16 19	15 18	16 14	15 0	1 38
2 43	14 28	16 49	14 23	16 32	14 18	16 14	1 33
2 48	12 21	18 10	12 17	17 53	12 13	17 35	1 27
2 53	10 1	19 40	9 58	19 23	9 54	19 6	1 20
2 58	7 23	21 21	7 21	21 5	7 18	20 49	1 13
3 3	4 18	23 19	4 17	23 3	4 16	22 47	1 5
3 8	0 32 W.	25 40	0 33 W.	25 25	0 33 W.	25 10	0 56
3 10	1 17 E.	26 45	1 15 E.	26 31	1 14 E.	26 16	0 52
3 12	3 22	27 59	3 19	27 45	3 17	27 32	0 48
3 14	5 50	29 25	5 47	29 12	5 44	28 58	0 43
3 15	7 18	30 15	7 14	30 1	7 10	29 48	0 40
3 16	9 0	31 10	8 54	30 57	8 48	30 44	0 37
3 17	11 2	32 16	10 53	32 2	10 46	31 49	0 34
3 18	13 42 E.	33 39 N.	13 29 E.	33 24 N.	13 17 E.	33 9 N.	0 31

Nautical Almanac Office,
1861, *Nov.* 2.

Observations of the Solar Spots. By Rev. F. Howlett.

Mr. Howlett presented to the Society a further series of drawings of solar spots. The following is extracted from the letter, dated St. Augustine's Parsonage, Hurst Green, Sussex, Nov. 5th, 1861, which accompanied the drawings:—

"The present series, continued from Nov. 15th, 1860, and brought down to Oct. 31st of the present year, consists of about seventy-three drawings of the whole solar disk, as magnified about 30 diameters, besides upwards of 200 separate spots, grouped or single, as amplified from 120 to 150 diameters.

"I may be permitted to remark that the wonderful commotions exhibited on the solar surface during the years 1859 and 1860 have scarcely, I think, been equalled at any period during the year which is now drawing to a close. These commotions,

indeed, would appear to be now calming down — consistently, so far, with the much-discussed eleven-year cycle of maximum and minimum of spots.

"At no time, however, this year have I ever observed the Sun to be entirely devoid of spots: the two barest days might, I think, be stated as the 1st Feb. and 9th Oct. last, as may be inferred from the condition of the disks when respectively depicted on the 2d Feb. and 10th Oct. (as shown in sheets Nos. 37 and 58); whilst the spots of the latter part of March, and of the last half also of April and May, were very grand (as see sheets Nos. 41, 43, 44, and 47, especially the last).

"The preponderance of spots occurred, as usual, in the Sun's northern hemisphere; indeed, during the ninety-nine days upon which I made records of these appearances, I found, as nearly as I could judge, that a northern preponderance obtained on 47 days, and a southern one on 28; the spots on the remaining 24 days of recorded observation being nearly equally distributed in both hemispheres.

"The longest series that I have been able to depict of the changes undergone by any one individual spot is that exhibited in nine separate drawings of the spot ν (see sheets 43 and 44), between the period of its first being observed by me on the 16th April and the condition it was in on April 26th, including the alteration suffered even between the hour of 7·30 A.M. and 3·0 P.M. on April 17th.

"A peculiar eddy seems to have strongly characterised the spot numbered 2, in group χ (sheet 54), as observed at 6·20 A.M. on July 29th, but which had nearly ceased, judging from appearances, at 2·15 P.M. on the same day.

"I may also, perhaps, be allowed to call attention to the manner in which I have endeavoured to represent, approximately, the inclination to the horizon, at different hours of the day, of the line of junction of two spots on the Sun's surface, as recorded also on July 29th. The subject is interesting, as far as the matter of spherical geometry is concerned; and not less so, perhaps, as regards the best time for drawing the solar disk — in the way, at least, with which I am obliged at present to content myself, as alluded to in my last communication to the Society.

"The absence of penumbra on the north-east side of so large a spot as β (see Aug. 19th, sheet 56) is, I should imagine, very unusual.

"I would only desire to remark, further, the impression which is increasingly felt by me of the extreme *shallowness*, by comparison, of the photospheric stratum in which is sunk the penumbra of spots generally, and even of the penumbral stratum itself; inasmuch as the nuclei commonly remain visible to almost the very edge of the disk, the penumbral border of a spot very seldom presenting much appearance of foreshortening, either; so far, at least, as I could perceive, though armed with

a Dawes's solar eye-piece, by Dollond, with a magnifying power of 200 diameters, and with an ordinary astronomical eye-piece, of about 300 diameters, appertaining to one of the Society's Sheepshanks Equatoreals, by Simms.

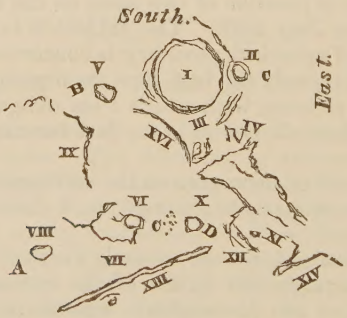
"This assumed shallowness of the *photosphere*, indeed, seems *proved* by Mr. Nasmyth's most interesting discovery of the thin layer of luminous lenticular bodies, of which that observer asserts the solar surface to consist.

"On the other hand, the *nuclear stratum*, or perhaps *strata*, appears to be of prodigious thickness, as may be inferred from the evidently vast depths into which the nuclear orifices descend, and as the varying intensity of blackness in different parts of the same nucleus seems also to bespeak. See series of large spot ζ throughout sheet 41, and series also of the grand spot ν in sheets 47 and 48, where the idea seems forced upon one, of chasms descending through cloudy strata, dozens or perhaps rather scores of thousands of miles in perpendicular depth."

Description of a portion of the Lunar Surface seen at Dr. Lee's Observatory at Hartwell, on the morning of July 31, 1861. By W. R. Birt, Esq.

The Roman numerals refer to the accompanying sketch which is taken from Beer and Mädler's map of the Lunar Surface.

I. *Cichus.* — A deep crater on the south-west extremity of a very rugged portion of high land, forming part of the south-east boundary of the *Mare Nubium*.



Mr. Webb thus speaks of *Cichus*:—

"*Cichus*, 189, on index map, a crater opened in table land, lies 9000 feet beneath the plateau, 4000 feet below the plain; its ring is perforated by a smaller crater, an object of

great interest. In 1833 I perceived that it was twice as large as it had been represented three several times by Schröter. On becoming possessed of the great map, I found it there also enlarged. Schröter, though a clumsy, was a faithful draughtsman; his views have the appearance of being each independently drawn, and they are under different angles of illumination, which often vary the size of small craters, so that here is *fair evidence of volcanic action* since 1792; the silence of Beer and Mädler being characteristic, goes for little or nothing."

Webb gives two figures; one, copied from Schröter's design, 1792, Jan. 4; the other, taken from Beer and Mädler's map. I am not in possession of Schröter's.

II. *Cichus* A, marked C in Beer and Mädler's map, a small but deep crater on the south-east margin of the ridge of *Cichus*. This small crater should be most carefully watched and measured; only a portion of the margin was seen this morning, as a projecting tongue of light into the dark shadow within the larger crater.

III. A crater north of *Cichus*, given in the small German map, but singularly omitted in the large map. There is a very obscure marking in the neighbourhood of the fault next to be described, *where I saw the crater exceedingly well defined;* but it has on the map not the remotest resemblance to a crater: it is situated between two mountain masses marked β and γ. This is also an object that requires close attention.

IV. A fault north-east of III., forming the south-west portion of a somewhat narrow triangular mass of very high land, about 5000 feet; see quotation from Webb. It is also very rugged. This mass of high and rugged land is well shown on the large German map.

V. A small crater west of *Cichus*, marked B on the large German map.

VI. A crater near the boundary of the *Mare Nubium*, forming with III. and V. an isosceles triangle, III. and V. being the base. The position of this crater, as I saw it, does not accord with its position on the large map. I apprehend it to be really more southerly than marked by Beer and Mädler. Westward of this are *four* small craters, which I failed to see. *Query*, were they too much advanced on the terminator?

VII. A portion of high land, on the south-east extremity of which *e* (VI.) is situated. The small German map gives a ridge hereabout; it does not, however, terminate as I saw it. It is very much better delineated on the large map.

VIII. A crater marked A on the large map, on the east edge of *Hesiod*, which is now on the terminator. Its outline is perceptible, but the floor is in perfect darkness.

IX. The east edge of a crater now in shadow, which does not appear to be given in the German map. The east ridge is, however, well given in the large map; it is connected with the

boundary of a large space south of *Hesiod*, presenting (on the map) the appearance of a large disrupted crater (unnamed).

X. A small crater marked D on the large map: it is north-east of *e* (VI.)

XI. A small crater nearly, but not quite, in a line with VI. and X., also given in the German maps, but delineated in the larger map as being much more diminutive in comparison with the craters in its neighbourhood than I saw it. It is *undesignated*, probably as having been an inconspicuous object at the date of Beer and Mädler's labours.

XII. A small serpentine mountain chain between X. and XI. given in the German maps.

XIII. A rille or canal brought out most exquisitely by the Hartwell telescope, but no traces of its consisting of minute craters, although examined with a power of 416. The utmost I could detect was a very narrow gutter-like formed canal running north-west and south-east, or thereabout, from *Hesiod* to near the steep and rugged south-east boundary of the *Mare Nubium*, the north-east interior slope being in shadow, the south-west in sunshine. I estimated it to be somewhat about a mile wide. It is well delineated on the German map, and is marked δ.

XIV. A short mountain-range running nearly at right angles from one extremity of the triangular mass of high land, described at IV., and at right angles generally to the steep and rugged boundary of the *Mare Nubium*, to the two craters *Mercator* and *Campanus*. It is given very distinctly on the larger map.

XV. A small conical mountain (?) very apparent north-east of, and closely abutting on, the rille or canal XIII. (δ). This is not given on the German map, and no traces whatever can be seen on the larger map. It would be well to watch very closely the neighbourhood of this mountain, especially as the surface of the *Mare* is exceedingly smooth, north-east of the canal.

XVI. Western edge of the high land forming the south-west part of the mass on which *Cichus* is situated; shown on the large map.

From VI. in the direction of X. towards XII., and as far as XIV., the surface is studded with small mountains (hillocks in comparison with the larger mountain masses), clearly separating the smoother spaces within IX. and XVI. from the general surface of the *Mare*. This appearance of being thus studded is shown on the larger map. The space between IX. and XVI. being separated from the general surface has greatly the appearance of having been a portion of a large ancient crater, probably broken up by the formation of this portion of the boundary of the *Mare Nubium*.

The above described observations were made with Dr. Lee's great Equatoreal, object-glass by Tully, on July 30, 1861, between 13 and 15 hours G.M.T. Power employed 240.

The Lunar Crater Plato.

Mr. Birt communicated a series of observations of this well-known crater, embracing a period of eighteen months, viz., from January 1860 to July 1861, which he had arranged according to the Moon's age, so that they not only served as a record of the past, but can also be used as an Ephemeris, indicating to the observer the appearances likely to be seen, and thus form the basis of an accurate course of observations on the physical aspects of *Plato*, and by means of which changes, if any, may be detected. There are several sketches of the spot and also portions of it. The observations are preceded by an index, referring to the Moon's age at which each observation was made, and followed by a summary of objects suitable for further telescopic observation in or near *Plato*. The whole are bound in a volume, which is deposited in the Library for reference and circulation.

On an Instrument for comparing Colours, proposed to be designated a Homochromascope. By W. R. Birt, Esq.

In the course of my observations on the physical characteristics of the Moon's surface, I found it necessary to devise some means for comparing with known standards of colour the tints of various portions, especially the dark-floored craters, the extensive grey plains, and the more luminous districts in immediate proximity with the rayed craters. After various trials, I found the instrument of which a somewhat rough model is now exhibited* the best adapted for the purpose. It is intended to consist of a moveable cradle, possessing a rack-work motion receiving one of a series of glass plates; on each plate a certain number of disks are painted with transparent colours, each colour being experimentally determined by means of an instrument similar in its construction and action to the colour top. The numerical value of every tint can thus be precisely ascertained. The cradle, with its plate of glass, is moved within a box having a circular aperture, top and bottom, exactly equal to the coloured disk; so that, while the strong light of a lamp enclosed in a lantern is thrown on a highly reflective surface attached to the box, the disk is viewed by the light thus reflected and transmitted through it. In this way, while the eye carefully contemplates the tints of the lunar disk, it is also able to compare them with the tints

* The model was exhibited at the Meeting.— Ed.

on the glass plates, which, being properly arranged and numbered, the tints observed can be easily registered. The instrument, mounted on a tripod, may be conveniently placed near the telescope for observation.

It is highly important that, in all observations with an instrument of this kind, the flame of the lamp should always be of the same intensity. This may be secured by a simple arrangement in the construction of the lamp and the burner. The construction of the instrument ensures permanency of tint in every other respect.

Results of the Meridional Observations of Small Planets; Occultations of Stars by the Moon; and Phenomena of Jupiter's Satellites: observed at the Royal Observatory, Greenwich, during the months of June to October, 1861.

(*Communicated by the Astronomer Royal.*)

Iris (7).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1861, June 5 9 55 0·1	14 52 12·22	109 52 52·70
12 9 23 6·8	14 47 49·58	.....

Irene (14).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1861, Oct. 4 13 54 11·2	2 49 5·82	85 6 19·01
11 13 21 52·4	2 44 17·64	85 32 41·28
22 12 29 31·3	2 35 10·04	86 13 6·78
26 12 10 9·7	2 31 31·46	86 26 30·64

Phocæa (25).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1861, Sept. 20 12 18 24·9	0 17 51·36	65 43 23·93
26 11 50 33·2	0 13 35·10	67 34 32·82
27 11 45 55·0	0 12 52·76	67 54 11·71
30 11 32 2·8	0 10 47·92	68 54 43·27
Oct. 4 11 13 41·3	0 8 9·61	70 18 14·85
9 10 51 5·8	0 5 13·14	72 5 4·88
11 10 42 11·6	0 4 10·62	72 48 3·05
19 10 7 30·7	0 0 56·37	75 36 38·05

Calliope (22).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1861, Sept. 12 11 12 25·4	22 40 9·31	120 47 44·84
Oct. 4 9 31 33·1	22 25 44·66	120 21 49·34

Bellona (28).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1861, Sept. 23 13 1 35·4	1 12 59·30	93 17 12·29
Oct. 11 11 37 21·9	0 59 29·91	95 27 52·16
14 11 23 13·2	0 57 8·58	95 46 52·83
22 10 45 49·0	0 51 10·66	96 30 55·27

Urania (30).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1861, June 27 11 52 14·4	18 16 30·02	115 22 39·46
July 4 11 17 8·8	18 8 54·64	115 19 3·65
11 10 42 33·5	18 1 49·51	115 12 54·83

Ariadne (43).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1861, Sept. 10 13 56 51·2	1 17 9·01	75 32 46·37
Oct. 11 11 26 51·5	0 48 57·79	78 24 5·09
14 11 12 9·8	0 46 3·36	78 46 39·54
19 10 47 58·9	0 41 31·32	79 24 28·19
22 10 33 41·0	0 39 0·68	79 46 29·44

Nysa (44).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1861, June 15 11 19 30·1	16 56 21·70	107 57 28·05

Europa (52).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1861, Oct. 4 12 7 18·3	1 1 55·42	93 56 7·94
22 10 43 46·1	0 49 7·39	95 22 52·42

Pseudo-Daphne (56).

Mean Solar Time of Observation.		R.A. from Observation.	N.P.D. from Observation.
	h m s	h m s	° ′ ″
1861, Sept. 3	9 33 5·8	20 25 4·37	97 36 41·29
5	9 25 11·9	20 25 2·31	97 51 51·54
12	8 58 33·7	20 25 55·59	98 43 11·06

Niobe (71).

Mean Solar Time of Observation.		R.A. from Observation.	N.P.D. from Observation.
	h m s	h m s	° ′ ″
1861, Aug. 19	12 19 43·9	22 13 1·62	89 55 19·32

All the observations of N.P.D. have been corrected for refraction and parallax, excepting that of *Niobe*, which has been corrected for refraction only.

Occultations of Stars by the Moon.

Day of Obs.	Phenomenon.	Moon's Limb.	Mean Solar Time.	Observer.
			h m s	
1861, June 25	18 Aquarii, disapp.	Bright	11 39 59·1	D.
Sept. 14	ϖ Capricorni, disapp.	Dark	8 3 44·0	E.
14	ϱ Capricorni, disapp.	Dark	9 17 44·1	E.
14	ϱ Capricorni, reapp. (*a*)	Bright	10 29 55·3	E.
Oct. 20	ξ Arietis, disapp.	Bright	7 16 34·0	N.
22	103 Tauri, disapp.	Bright	12 35 58·4	M. D.

(*a*), Perhaps doubtful to one or two seconds.

The initials D., E., M. D., and N. are those of Mr. Dunkin, Mr. Ellis, Mr. Dolman, and Mr. Newcomb.

Phenomena of Jupiter's Satellites.

Day of Observation.	Satellite.	Phenomenon.	Mean Solar Time.	Observer.
1861.			h m s	
June 12	I.	Occ. disapp, first cont.	9 57 15·0	C.
12	I.	,, total disapp.	9 59 44·5	C.
13	I.	Egress, bisected. (*a*)	9 40 51·5	J. C.

(*a*) The planet very tremulous and diffused.

The initials C. and J. C. are those of Mr. Criswick and Mr. Carpenter.

Occultation observed at Highbury. By T. W. Burr, Esq.

1861, September 14th. The star ξ *Capricorni* was occulted instantaneously by the dark limb of the Moon at $20^h\ 52^m\ 38^s{\cdot}9$ local sidereal time. Telescope 4 ft. 4 in. focus, $3\frac{3}{8}$ in. aperture, power 173. Longitude 24^s W.

Nov. 7th, 1861.

Places of the Comet II., 1861, *from Sextant-Observations of the Distances of the Comet from Fixed Stars, made by Commander A. L. Mansell, R.N., commanding H.M.S. Firefly, and reduced under the superintendence of the Rev. George Fisher, Principal of the Greenwich Hospital Schools, by the Officers of that Establishment.*

(*Communicated by the Astronomer Royal.*)

A short time since, the Admiralty placed in my hands a sheet of observations of the distances of the Comet II., 1861, from fixed stars, made by Commander A. L. Mansell, accompanied with the particulars which were absolutely necessary for their reduction, but with nothing tending to facilitate the reduction. At my request, the Rev. George Fisher most kindly took charge of the observations, and under his care they were reduced by the Officers of the Greenwich Hospital Schools.

The observations were made on board H.M.S. Firefly, her anchorage being within a quarter of a mile of the observatory-station used in the survey of Sidon, the position of which is—latitude $33^\circ\ 34''\ 26'$ N., longitude $35^\circ\ 21'\ 39''$ E. The latitude is determined from a mean of four meridian altitudes of α and β *Libræ* south of the zenith, and ten observations of *Polaris*, using the *Nautical Almanac* method. The longitude is determined from three good meridian distances from Beirut, using eight chronometers; Beirut being fixed by a mean of seven meridian distances, using seven chronometers, run between it and Malta. The longitude of Malta is deduced from that of the Observatory at Palermo. [It will be remarked, in the subsequent computations, that a small error of latitude produces no error in the deduced place of the comet, except in so far as it alters the computed altitude of the star and comet, and therefore slightly alters the refraction and the correction of distance; and a small error of longitude produces no effect, except in the correction of distance for refraction, and in the computation of the comet's place from the Ephemeris.] Mean time was deter-

mined by equal altitudes of the Sun on the 2d and 8th of July. $\frac{210}{3063}$ is a good pocket-chronometer, by French: it has however always been compared with the standard chronometer (Dent, 1793), which watch shows a good mean of the nine chronometers.

The elements given are—the Greenwich mean time of each observation, and the observed distance, index-error, and corrected apparent distance.

It does not appear necessary to give all the numbers of the observations, or the troublesome reductions, but it may be proper to describe the method pursued:—

1. The Comet's R.A., N.P.D., and log. distance were interpolated from the Ephemeris published by M. Le Verrier in the *Bulletin*. The hour-angle being found, the true altitude was computed; and by calculation of refraction and parallax, the apparent altitude was found.

2. The Star's R.A. and N.P.D. being taken from the *Nautical Almanac*, its true altitude was computed, and by calculation of refraction the apparent altitude was found.

3. From the two apparent altitudes and the measured distance, with the corrections of altitudes, the true distance was found by the usual method of clearing Lunars.

4. The distances of the Comet from the two stars were measured at different times. But on each of the evenings the distance of the Comet from at least one star was measured twice; and the change of distance for a known interval being thus found, it was always possible to reduce to the same moment the measures of distance from two stars.

5. With the R.A. and N.P.D. of the two stars, the distance between them was soon found, and the angle made by that distance with the meridian of one star. The three sides of the triangle formed by the Comet and two stars being known, the angle at the star last mentioned was computed. Applying this angle to the angle just mentioned, the angle made by the Comet's distance with the star's meridian was found. The necessary elements for computing its diff. R.A. and its N.P.D. were thus completely obtained.

The following are the results for the Comet's place:—

Day. 1861.	G.M.T. h m s	Comet's R.A. h m s	Comet's N.P.D. ° ′ ″	Stars from which the Comet's Distance was measured.
July 1	6 17 30	7 17 43·75	35 49 19·3	Polaris, Spica.
	6 21 13	7 17 54·55	35 45 24·7	Spica, α Coronæ.
	6 40 53	7 18 37·46	35 43 37·5	Polaris, Spica.
	6 42 25	7 18 43·80	35 39 39·4	Spica, α Coronæ.
2	6 6 17	8 17 30·55	28 40 28·4	Polaris, Spica.
	6 9 28	8 17 48·02	28 36 30·0	Spica, α Coronæ.
	8 52 33	8 25 7·69	28 3 56·1	Polaris, Spica.

Day. 1861.	G.M.T. h m s	Comet's R.A. h m s	Comet's N.P.D. ° ′ ″	Stars from which the Comet's Distance was measured.
July 2	8 58 24	8 25 27·25	28 1 0·3	Spica, α Coronæ.
4	6 11 2	10 38 18·35	23 6 1·4	Spica, α Coronæ.
	6 15 19	10 37 49·00	23 9 9·7	Polaris, Spica.
5	7 44 33	11 39 5·43	23 32 3·8	Polaris, Arcturus.
	7 46 52	11 39 14·10	23 31 33·6	Arcturus, α Lyræ.
6	8 28 11	12 21 59·50	24 51 2·6	Polaris, Arcturus (not favourable).
	8 30 37	12 22 57·85	24 47 42·5	Arcturus, α Lyræ.
8	6 23 16	13 14 31·54	27 42 22·0	Polaris, Arcturus (unfavourable).
	6 29 40	13 14 43·99	27 42 38·1	Arcturus, α Lyræ.
9	6 32 26	13 31 43·01	29 9 5·8	Polaris, Arcturus (unfavourable).
	6 36 10	13 32 12·24	29 8 35·3	Arcturus, α Lyræ.
10	6 24 29	13 43 48·79	30 26 10·4	Polaris, Arcturus (unfavourable).
	6 28 28	13 45 33·27	30 24 20·3	Arcturus, α Lyræ.

November 4, 1861.

Places of Comet II. 1861. By N. M. R. Edmondson, Esq., Assistant, Armagh Observatory.

(*Communicated by Dr. Robinson.*)

G.M.T.	R.A. h m s	Par. in R.A. s	N.P.D. ° ′ ″	Par. in N.P.D. ″
July 1·4516	7 28 6·38 + ϖ × 0·0406		34 17 24·94 − ϖ × 0·8468	
2·5157	8 36 7 *		27 20 *	
5·4739	11 46 52·63	0·0965	23 44 3·01	0·3383
6·4883	12 28 16·27	0·0908	25 18 19·22	0·3200
7·4954	12 57 27·90	0·0864	26 32 1·64	0·3088
9·4864	13 34 59·05	0·0755	29 25 58·07	0·2480
10·4464	13 47 43·69	0·0628	30 39 20·46	0·1304
14·4583	14 18 48·34	0·0570	34 36 52·47	0·1968
16·4787	14 27 38 *		36 5 *	
18·4496	14 34 43·12	0·0515	37 13 3·49	0·2143
21·4722	14 42 27 *		38 34 *	
23·4581	14 46 32·56	0·0520	39 26 16·47	0·2798

* Approximate.

	Comparison Stars.	Assumed Places.	Obs.
(1)	Federenko's Lalande 1166	Lalande	1
(2)	R.A. = $8^h\,36^m\,1^s$*, N.P.D. = 27° 14′		2
(3)	Lalande 22785	ditto	4
(4)	Groombridge 1888	{ R.A. from Radcliffe / N.P.D. from Armagh }	3
	,, 1926	Armagh Catalogue	4
	P. xiii. 110	ditto	4
	,, 233	ditto	5
	Groombridge 2102	ditto	5
	R.A. = $14^h\,34^m\,42^s$*, N.P.D. = 36° 0′*		3
	P. xiv. 164	ditto	5
	R.A. = $14^h\,7^m\,48^s$*, N.P.D. = 38° 33′*		1
	Radcliffe Catalogue	Radcliffe Catalogue	3

* Approximate.

Nov. 9th, 1861.

The Hydrographer of the Admiralty has communicated Observations taken by Mr. J. F. Krabbe, Master H. M. S. Meander, at Ascension Island, 1861, July 4, 8, and 29, of a Comet seen there, and which is, in fact, Comet II., 1861. The observations are sextant observations of the distances from three stars.

Sir Thomas Maclear, Director of the Royal Observatory at the Cape of Good Hope, has communicated to the Society a series of Right Ascensions and North Polar Distances of Comet III., 1860, deduced from observations made with the $8\frac{1}{2}$-feet Equatoreal at the Observatory. The observations extend from 9 July to 18 Oct. 1860. The paper probably will appear *in extenso* in the *Memoirs* of the Society.

Observations made at the Dudley Observatory, Albany, New York. By G. N. Hough, Esq., Assistant.

(*Communicated by Prof. O. M. Mitchell, Director of the Observatory.*)

Observations of Comet II. 1861, *made with the Equatoreal.*

Date.	M.T. of Obs. h m s	App. R.A. h m s	App. Decl. ° ′ ″
Aug. 3	10 30 17·56	15 2 47·41	+47 29 14·87
10	10 54 35·16	15 10 38·48	
14	11 0 47·20	15 14 55·95	+45 34 20·17
15	9 57 45·91	15 15 57·44	

Aug. 3	Comp. *, 4961 Rumker	3 Comp.		
10	,, 15266, 15309 Arg.	5 ,,		
14	,, 15272, 15290 Arg.	7 ,,		Comet faint; moonlight
15	,, 15290 Arg.	6 ,,		Comet faint; moonlight

Occultation of 101 *Piscium by the Moon.*

1861, Aug. 24 $11^h\ 26^m\ 31^s{\cdot}0$ Mean Time.

Disappearance instantaneous. Telescope (13 in.) Equatoreal.

Observation of Minor Planets made with the Olcott Meridian Circle at the Dudley Observatory.

Calliope (22).

1861.	M.S.T. of Obs. h m s	App. R.A. h m s	App. Decl. ° ′ ″
Aug. 30	12 13 55·49	22 51 23·25	
31	12 9 6·87	22 50 30·40	−30 23 24·79
Sept. 4	11 49 51·57	22 46 58·15	−30 28 33·21
9	11 25 49·98	22 42 35·38	−30 42 27·33
12	11 11 29·18	22 40 2·28	−30 48 58·88
13	11 6 45·26	22 39 13·74	−30 49 17·53

Themis (24).

1861.	M.S.T. of Obs. h m s	App. R.A. h m s	App. Decl. ° ′ ″
Aug. 31	12 23 10·43	23 4 36·27	−6 55 42·58
Sept. 1	12 18 31·97	23 3 53·60	−7 0 2·65
4	12 4 35·23	23 1 44·23	−7 13 8·93
9	11 41 18·94	22 58 6·89	−7 34 52·85
12	11 27 22·48	22 55 57·79	−7 47 41·83
13	11 22 45·01	22 55 16·11	−7 51 47·38
24	10 32 11·52	22 47 56·40	−8 34 23·38

On a New Observing Clock. By Prof. C. Piazzi Smyth Astronomer Royal for Scotland. (Abstract.)

The desideratum of obtaining a clock with an easily audible seconds' tick has been realised by Mr. R. L. Jones' patent method, to which Prof. Smyth was introduced by letters from Sir T. Maclear and Mr. Hartnup; and Mr. Jones himself procured a second-hand cast-iron barrel clock without striking parts, and having introduced into it his magnetic pendulum brought to the Edinburgh Observatory in April last, and

erected it in front of the transit instrument and in electric connexion with the old transit clock, removed for this purpose out of its former position and into the central hall of the Observatory.

The new observing clock goes as accurately as, because simultaneously with, the old transit or regulating clock, but with a vigour or mechanical power more than three hundred times greater, its driving weight being 180 lbs., descending 10 feet in one day, instead of 5 lbs., descending 3 feet in 7 days. The seconds' tick, though loud, was at first a peculiarly slumberous, heavy, and mournful sound, but this was remedied, as suggested by Mr. F. Ritchie, clockmaker in Edinburgh, by obtaining the seconds beat, not in the usual and almost invariable method by the escapement, but, by introducing for the purpose a tilt hammer striking on an anvil, the escapement being rendered noiseless, so as not to interfere with the note of the hammer. The most appropriate quality of sound was found to be produced by a steel hammer striking on an anvil of hard olive wood, hollowed out below, so as to be under one quarter of an inch thick. It would have been an advantage, as regards loudness, to have the hammer and anvil outside the case of the clock in the free open air of the room: this was not actually done, but the casing was taken in the form of a wooden tubing to them, and almost as loud a beat was obtained. The cost of the production of the electricity is trifling, and, as regards the first cost of the apparatus, Mr. Ritchie, having been recently applied to on the part of a Canadian Observatory, has estimated the cost of a big observing clock, with its hammer, anvil, and galvanic battery, at one-third to one-fourth part of the expense of a first-rate regulator or an ordinary astronomical transit. A collateral advantage has been found to be, that the old transit clock, as now locked up in a closet and used only to regulate the observing clock, remains in a more equable temperature.

Major A. Strange, late Astronomical Assistant in the Great Trigonometrical Survey of India, has sent to the Society three papers:—

"On Testing the Vertical Axes of Altazimuth Instruments."

"On a Direct Method of Testing and Adjusting the Equipoise of Altazimuth Instruments."

"On a proposed Isolated Flange for Conical Axes."

It would be useless to attempt giving an abstract of these elaborate papers, relating, as they do, to instrumental details, and requiring the illustration of a series of figures.

Information has been received of the death of M. Daussy, Member of the Bureau des Longitudes at Paris, and an Associate of the Society.

RECENT PUBLICATIONS.

Astronomical Observations made at the Sydney Observatory in the year 1859. By W. Scott, M.A., Astronomer for New South Wales. Sydney, 1860. 8vo. pp. i. to xxiv. and 1 to 112.

In the *Monthly Notices*, vol. xix. p. 293, are printed some extracts from the first Annual Report to the Observatory Board, 22d Dec. 1858, giving an account of the establishment and the position of the Observatory. The Transit Circle arrived from England about the end of December 1858; but the regular observations were not commenced until June 1859.

It appears by the observations published in the *Monthly Notices*, vol. xx. p. 77, that the latitude and longitude of the Observatory were provisionally found to be Lat. 33° 51′ 41″·1 S.; Long. $10^h\ 4^m\ 59^s{\cdot}86$ W. The corrected values, as given by the Observations of Zenith Distances of *Nautical Almanac* Stars and the Observations of Moon-culminating Stars during the year 1859, are found to be Lat. 33° 51′ 40″·8 N.; Long. $10^h\ 4^m\ 59^s{\cdot}96$ W.

The greater part of the volume is occupied with Transit and Zenith-distance Observations of Stars; and from these are deduced the mean right ascensions and north polar distances for 1st January, 1859. It is from the internal evidence afforded by these that an estimate can be formed of the amount of reliance to be placed on the results which may hereafter proceed from the Observatory.

The causes of error are in a great measure of a temporary nature; such, for instance, as the changes in the piers of the instrument, owing to the contraction of the sandstone; but the results indicate also a permanent instrumental error, such as an irregularity in the form of the pivots. The errors of observation are not greater than those which occur in observatories of a high class, as those at Oxford and Cambridge, and are such as to disappear to a great extent when the mean of four or five observations is taken; but the instrumental errors are such that, although the circle may be regarded for some purposes as a useful instrument, yet it cannot be classed among instruments of the highest order, nor can its results compare in accuracy with those obtained at the Royal Observatory at the Cape of

Good Hope. It was therefore desirable to avoid as much as possible observing the same stars as had recently been, or would soon be observed, at the Cape of Good Hope. But, in the absence of information from thence, it was decided to observe, in addition to *Nautical Almanac* stars, only those stars of the 6th and 7th magnitudes which are given in the British Association Catalogue or in Lacaille's New Catalogue; and up to the end of 1859 the observations were limited to a space of 10° on each side of the zenith. But the equatoreal telescope, which has been ordered of Messrs. Merz and Son (7 inches French in aperture and 9 feet 8 inches focal length), and is in course of construction, when it arrives, may perhaps give a totally different direction to the efforts of the Observatory.

Taschenbuch für Mathematik, Physik, Geodäsie, und Astronomie. Von Dr. Rudolf Wolf, dritte umgearbeitete und erweiterte mit 22 Tabellen und 5 Figurentafeln ausgestattete Auflage, 12mo. Bern, 1860, pp. 1–269.

This little volume appears to be a most convenient handbook, comprising the utmost possible information for its bulk on the subjects to which it relates, and the author's name is a guarantee for the character of the work.

Memoria sobre el Eclipso de Sol de 18 *de Julio de* 1860. Por D. Francisco de Paula Marquez, Capitan de Navio de la Armada, y Director del Observatorio de Marina de S. Fernando. Publicada de Orden Superior. 8vo. Madrid, 1861.

The work contains an account of the Observations of the Eclipse, made at Oropesa, on the east coast of Spain, near the central line, by the Spanish Naval Commission under the command of D. F. Marquez, in company with the Portuguese Commission from Coimbra. It contains also an elaborate "Optical" theory of the Corona, Red Prominences, and other phenomena of the Eclipse, considered as arising from the diffraction and reflexion in our atmosphere of the light refracted at the border of the Moon's disk, and from the motion of the Moon.

Beobachtung der totalen Sonnen-Finsterniss vom 18 (6) *Juli*, 1860, *in Pobes.* Nach den Berichten der einzelnen Theilnehmer zusammengestellt von Otto Struve. Mit 3 Tafeln. (From the *Mém. de l'Acad. de St. Pét.* t. iv. 1861.)

The party from Pulkova who joined the Himalaya Expedition consisted of M. O. Struve, Dr. Winnecke, and the Portuguese Astronomer, Lieut. Oom, and the memoir contains an account of the observations of the Astronomer Royal, the three Pulkova Astronomers, and Herr C. Weiler, at or near Pobes, and of Herr Stenglein at Lodio, a few miles south of Bilbao.

Mémoire sur l'intégration des Equations différentielles relatives au Mouvement des Comètes, établies suivant l'hypothèse de la force répulsive definie par M. Faye, et suivant l'hypothèse d'un Milieu résistant dans l'espace. Par Jean Plana. (*Turin Memoirs*, t. xxi. 1861.)

This memoir, dated 12 Sept. 1861, replaces one with the same title presented to the Turin Academy, 26 May, 1861, the numerical results of which were erroneous, in consequence of an error of transcription in one of the formulæ. The conclusion arrived at is stated to be, that while the hypothesis of M. Faye gives results approaching those observed for the two periodic comets of 1205 days and 2718 days (Encke's and Faye's), a better agreement with the results of observation is obtained by the hypothesis of a resisting medium. The investigation relates exclusively to the motion of the centre of gravity of the comet.

M. Faye's hypothesis, referred to in his paper, *Comptes Rendus*, 4 March, 1861, consists in supposing that there is a repulsive force emanating from the incandescent surface of the Sun, and, like the attractive force, varying as the inverse square of the distance, but which, in consequence of the finite velocity of propagation, acts in a direction inclined to that of the radius vector.

Tabulæ Quantitatum Besselianarum quibus Apparentes Stellarum Positiones in Medias convertuntur, adhibitis Numeris Constantibus Pulcovensibus pro annis 1840 *ad* 1864 *computatæ.* Ed. O. Struve. 8vo. Pet. 1861.

The tables are based on the formulæ and numerical values of the constants of precession, nutation, and aberration, given

in Peters' well-known work, *Numerus Constans Nutationis*, &c., Pet. 1842.

They contain for the 25 years to which they relate the logarithms of the quantities A, B, C, D, and the quantity τ for 0^h Pulkova sidereal time of each day. The quantity E, which varies very slowly, is given only for the last day of each month. Besides the logarithms of A, B, C, D, there are given, in the cases where the rapid variation of the logarithms renders it necessary for accuracy, the natural values of B, C, D.

Arc du Meridian de 25° 20′ entre la Danube et la Mer Glaciale, mésuré depuis 1816 jusqu'en 1855. Sous la direction de C. de Tenner, Général d'Infanterie de l'Etat-Major Impérial de Russie, Chr. Hansteen, Directeur du Departement Géographique Royal de Norvège, N. H. Selander, Directeur de l'Observatoire Royal de Stockholm, et F. G. W. Struve, Directeur de l'Observatoire-Central-Nicolas de Russie. Ouvrage composé sur les différens Matériaux et rédigé par F. G. W. Struve. Publié par l'Académie des Sciences en St. Pétersbourg. Tome premier, Opérations géodésiques entre le Danube et le Golfe de Finlande, St. Pét. 1860. Tome deuxième, Opérations Géodésiques entre le Golfe de Finlande et la Mer Glaciale. St. Pét. 1857. Deux volumes, 4to. avec Atlas de 26 planches.

The introduction to vol. i. contains the general history of this great geodetical undertaking. The total arc, comprised between Fuglenœs, lat. 70° 40′ (near the North Cape), and Staro-Nekrassowka, lat. 45° 20′ (near the mouth of the Danube), is 25° 20′ in latitude. It is composed of 258 principal triangles, with 10 measured bases, not reckoning among the 258 triangles the triangles which effectuate the junction of the bases with the chain of triangles. The distance between the extreme points, measured on the great circle joining them, is 2700 versts = 2880 kilometers = 1552 geographical miles. The Observatory of Dorpat is about half-way between the extreme points, and may be considered as the meridian of the total arc.

The total arc is divided into two principal portions, a southern and a northern arc, meeting at the Island of Hogland in the Gulf of Finland; in fact, the triangles of the two arcs form two distinct series, having a common point at Mäki-Pääläys in Hogland, but without any common side connecting the terminal triangles of the two arcs.

There are on the total arc 13 points where the azimuth and latitude have been astronomically determined. The Observatory of Dorpat is the only point the longitude whereof

has been determined with eminent precision, by the chronometric comparison in the year 1854, between Dorpat and Pulkova.

In a statistic and chronological point of view, disregarding the observations of latitude which were in part repeated at a posterior epoch; the total arc may be divided into seven parts, which are

Arc of	Between Latitudes.		Measured under direction of	In the Years
	° ′	° ′		
1. Bessarabia	45 20	— 48 15	M. de Tenner	1844–1852
2. Podolia and Volhynia	48 15	52 3	ditto	1835–1840
3. Lithuania	52 3	56 30	ditto	1816–1828
4. Baltic Provinces	56 30	60 5	M. Struve	1816–1831
5. Finland	60 5	65 50	ditto	1830–1851
6. Lapland	65 50	68 54	M. Selander	1845–1852
7. Finmark	68 54	70 40	M. Hansteen	1845–1850

and the history may be divided into four periods, embracing 1. The origin of the undertaking, and the operations of MM. de Tenner and Struve relating to the arcs of Lithuania and the Baltic Provinces, united into a single arc of 8° 2′. The period terminates in 1831.

2. The period 1830 to 1844 comprises the continuation of the meridian northwards to Tornea, latitude 65° 50′, and the preparations for the Southern continuation as far as the Dniester.

3. From 1844 to the end of the year 1851, comprising the continuation southwards to the Danube and northwards to the Arctic Ocean.

4. The supplementary operation posterior in date to 1851, intended partly to reduce to uniformity and a higher degree of perfection the data requisite, as well for the union of the different partial arcs, as for the utilisation of this arc for the determination of the figure of the Earth.

There is given, pp. cxli. to cxliii., a chronological catalogue of the different publications in the *Astronomische Nachrichten*, the *Memoirs* and *Bulletins of the Academy of St. Petersburg* and elsewhere, in relation to the measurement of the arc of 25° 20′.

The astronomically determined latitudes in the Russian-Scandinavian Arc of 25° 40′ are not, as in the English Ordnance Trigonometrical Survey, corrected for the deviations of the plumb-line due to the calculated attractions of the ine-

qualities of the surface in the neighbourhood of the Station. It appears that in the opinion of General de Schubert, this correction should have been made; and with a view thereto, there should be a careful levelling of all the astronomical stations, or at least of certain specified astronomical stations, on the arc. The question is discussed by M. Otto Struve in a paper in the *Bulletins of the Academy of St. Petersburg* ($\frac{8}{20}$ Feb. 1861), in which he maintains the contrary opinion, that this correction ought not to be made.

Astronomical Observations made at the Observatory of Cambridge. By the Rev. James Challis, M.A. &c. Vol. xix. for the years 1852, 1853, and 1854. 4to. Camb. 1861.

The volume contains the Observations made with the Transit and Mural Circle in the years 1852, 1853, and 1854, the Observations of Planets and Comets with the Northumberland Equatoreal in the same interval being reserved for separate publication with those of preceding years.

The major part of the observations of the three years are directed towards the determination of the places of stars, and more especially such as are included in the list of 8000 zodiacal stars, observations of which were commenced in 1849.

The observations of the Moon and Moon-culminating Stars were discontinued at the end of 1852. The Sun, the Planet *Neptune*, and the Minor Planets, were observed in that and the two following years. All these observations were compared calculated places, and if no Ephemeris was available for the purpose, the places were directly computed from elements of the orbits.

Astronomical and Meteorological Observations made at the Radcliffe Observatory in the year 1858. Under the Superintendence of Manuel J. Johnson, M.A., late Radcliffe Observer. Reduced and Printed under the Superintendence of the Rev. R. Main, M.A., Radcliffe Observer. Vol. xix. Published by order of the Radcliffe Trustees. 8vo. Oxford, 1861.

Instruments for Sale.

The Radcliffe Observer is empowered to offer for sale the Transit Instrument and Meridian Circle which have been in use since the commencement of Mr. Johnson's directorship till the present time, but which are now unnecessary on the establishment of the Carrington Transit Circle.

The Transit Instrument has an object-glass of 4 inches clear aperture, with a focal length of 8 feet, and is an excellent instrument of its class. Price 120*l.* without the piers.

The Meridian Circle, by Jones, is 6 feet in diameter, and its telescope, of the same focal length, has a clear aperture of 4 inches. It cost about 1000*l.* Price without its piers 300*l.*

The piers may be taken at a valuation at the discretion of the purchaser.

The Astronomer Royal has been requested by the Rev. George Fisher to state that Commander Mansell's Comet observations (see page 16) were computed by the senior boys of the Nautical School, under the direction of John Riddle, Esq., Head Master of the Nautical School.

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